SCHOOL OF MEDICINE
CASE WESTERN RESERVE UNIVERSITY

CWRU NEUROSCIENCES DEPARTMENT GRADUATE STUDENT HANDBOOK

Table of Contents

please send any corrections for the handbook to Katie Wervey (kar18@case.edu)
Last updated: 9/2/2022

Neurosciences at CWRU

The Department of Neurosciences, located in the East Wing of the CWRU Medical School (Robbins Building) offers graduate education and postdoctoral training in a wide range of disciplines in modern neuroscience. Training is provided through a combination of research, course work and seminars. The department hosts weekly seminars, journal clubs, a social hour, and invites talented undergraduates to participate in research over the summer. Thesis research opportunities are available with more than 20 faculty members working in areas such as development of motor and sensory systems, regeneration, pathfinding by axons, neurogenetics, regulation of neurotransmitter expression, neuron-glial interactions, synaptic physiology and plasticity, ion channel biophysics and information processing. One feature of the Department that makes it particularly attractive is the highly interactive atmosphere, characterized by extensive collaborations among laboratories and with other investigators.

Neurosciences Department Office: SOM E653
Phone: 216-368-6252 FAX: 216-368-4650
Web site: https://case.edu/medicine/neurosciences/

Training Philosophy

Graduate education in Neurosciences at CWRU addresses many aspects of the science profession, and involves both formal coursework and informal interactions. Both faculty and students prosper when students are considered as promising junior colleagues, deserving dedicated guidance from the scientific community.

"The Doctor of Philosophy degree is the highest academic degree granted by North American universities. It is a research degree and is to be distinguished from other doctorates such as the M.D., J.D. or Ed.D. degrees, which are designed for professional training or which focus on applied rather than basic research.... **The Doctor of Philosophy degree is designed to prepare a student to become a scholar**, that is, to discover, integrate and apply knowledge, as well as communicate and disseminate it...The program emphasizes the development of the student's capacity to make significant original contribution to knowledge in a context of freedom of inquiry and expression." -Council of Graduate Studies

Neuroscientists today require many skills to succeed in a competitive environment. Our Neuroscience students can expect training in 1) scientific excellence, with close interactions with faculty advisors leading to an understanding of problem-solving, critical analysis of data and modern technical approaches, 2) communication skills, including practice and advice in the analysis of contemporary literature, grantsmanship, and oral presentations and 3) Ethics, to make complex decisions on authorship, data handling, and intellectual property.

Student Activities. Graduate students are expected to initiate and participate in a variety of activities having to do with professional growth:

Departmental Representatives to Case programs. All departments contribute to the CWRU Graduate Student Council that discusses issues that affect graduate students. To get involved or explore the GSC, visit their web site at: http://gsc.case.edu/.
Journal Clubs and Seminars. Journal clubs and seminars offer an opportunity to learn about broad areas of Neuroscience, and form an important part of graduate training. All

students, postdoctoral fellows and faculty are expected to attend both the Journal Club Mondays at noon (SOM E646) and the Neurosciences Seminar Thursdays at noon (BRB105 unless otherwise specified). Students are strongly encouraged to actively participate by asking questions at seminars and journal clubs. **Dr. Richard Zigmond (rez) organizes the seminar schedule and Dr. Heather Broihier (htb) organizes the journal club calendar.**

To gain oral presentation skills, students should make formal presentations to the Neuroscience community at least once a year*, after practice with their faculty advisors*. Students in the first 3 years may elect to present a current research article. Students in the third year or later can select alternatively (with consultation of their faculty advisor) to give a presentation on their research. Faculty offer constructive criticism to the student directly following the presentation.

Two students will be selected each year, by vote of the Graduate Education Committee, to be honored for either "Best Presentation by a Pre-candidacy Graduate Student" or "Best Presentation by a Doctoral Candidate". Awards for these achievements, in the form of a certificate, will be presented upon the first journal club of the following academic year.

Meeting outside speakers for lunch. Students and postdoctoral fellows are encouraged to meet with visiting speakers at lunch following the noon seminar. This is a good opportunity to practice talking about science in a concise, interesting way. Further, it offers a means to get to know the speaker, his/her institution and to discuss scientific strategies or collaborations. To meet with a speaker, contact the student lunch coordinator to reserve a free lunch. A student should seek to meet with at least 4 speakers a year.

Student-sponsored departmental speaker. One speaker a year is selected and sponsored by the graduate students in the Department. Visiting faculty are honored by this distinction and are very accessible to students during the visit. Faculty input about candidates is encouraged to ensure that "student-friendly" speakers are selected. Students create the schedule for the speaker, arrange lunch with students and postdocs, introduce the speaker at the seminar, create a department-wide dinner with the speaker, are responsible for transit to and from the airport and hotel reservations.

Graduate Student Symposium. The graduate students in the biomedical sciences organize a symposium once a year that includes student posters and a keynote speaker invited by students. The faculty advisor for this program is David MacDonald. Many student issues are represented by the National Association of Graduate and Professional Students (http://www.nagps.org/).

Attending national meetings. Students are encouraged to present their work at national meetings once a year. The most appropriate meetings may be the Society for Neurosciences Annual Meeting or a Gordon Conference. Students should compete for individual travel grants as well as funds from training grants. MSTP students often can get partial reimbursement for meeting costs if they present a poster or talk at a scientific meeting.

Recruitment of prospective graduate students. Often the most candid view of our program comes from current students, and that viewpoint is very valuable to prospective students. Students host prospective students from other institutions during the Spring recruitment weekend, and serve as ambassadors of the institution and program.

Individual Predoctoral Support. Once accepted, graduate students who train with Neurosciences Department P.I.s are guaranteed stipend support by the Department for five years if they remain in good standing. Support for additional years may be provided but requires an individual petition. Students who choose to train with P.I.s outside the Department of Neurosciences should note that tuition and stipend support will be the responsibility of the training P.I. and his/her department. A letter of support is required from the training P.I. and chair of department stating that tuition and stipend will be guaranteed for at least five years. This letter must be received by the Department of Neurosciences before a student begins training with the chosen P.I. Stipend support may derive from NIH training grants, NIH individual research grants, federal and private research grants and university resources. Tuition is generally paid by the training faculty member's primary department. It is highly advantageous for students to successfully compete for individual grant support from extramural sources, and the department strongly encourages such applications. Neuroscience students have been successful in obtaining National Research Scholar Fellowships from the NIH (please see http://grants.nih.gov/grants/guide/notice-files/NOT-OD-07-052.html) and the American Heart Association (please see http://www.americanheart.org/presenter.jhtml?identifier=2457#Predoc). Note that several agencies require applications early in graduate training. The Office of Graduate Education maintains a list of graduate funding opportunities http://casemed.case.edu/gradprog/grantsources.html.

Graduate Stipend and Benefits

Full time registered Neuroscience students are eligible for tuition and stipend support (see above). The stipend level is currently $33,500 for twelve months for the 2022-2023 academic school year. Stipends are funded by NIH training grants, NIH individual research grants, federal and private research grants and university resources. In August, 2000, the Dean of Graduate Studies informed students that "… income tax will be withheld only on the stipend portion of compensation (stipend plus tuition) charged to federal research grants." Note that students may also be required to pay local taxes if they live outside the city of Cleveland. Information can be obtained from each municipality. The Department pays for student health services. A copy of the CWRU Medical Plan for Students can be obtained at the University Health Services, 2145 Adelbert Road.

Program Policy for Trainees whose faculty advisor moves to another institution

In the event that a PhD trainee's advisor moves to another institution the program policy concerning continuation of training of a trainee in the program at CWRU is as follows. PhD trainees who have completed less than three years of training will not be permitted to continue training in the Neuroscience's PhD program. Trainees who have completed at least three years of training will be permitted to continue training pending review and written approval of the trainee's thesis research progress by the trainee's thesis committee and the training program's GPD. If a trainee is granted approval to continue in the program, the Department of Neurosciences will discontinue responsibility for the trainee's stipend and tuition support after the departure of the trainer. To continue as a Neurosciences trainee at CWRU while at another institution, the trainee's advisor must provide, prior to his/her departure, an official written contract from the advisor's new institution stating that it will assume full financial responsibility for the trainee's stipend and tuition. The trainee must arrange to meet regularly with his/her thesis committee to present progress according to the guidelines described in the handbook for all PhD trainees. The advisor must return to physically meet with the trainee and the thesis

committee every 6 months. Any deviations from this policy must be approved by the departmental Chair.

University Health Service 216-368-2450
Appointments:
General Clinic 216-368-4539
Women's Clinic 216-368-2453
Mental Health 216-368-2510
University Counseling Service 216-368-2510

Neurosciences Program Requirements
It is the responsibility of the student to become familiar with the general rules and regulations of the University (available in the General Bulletin http://www.case.edu/bulletin/) and Graduate Studies (https://case.edu/gradstudies/) as well as the specific rules which apply for the course of study in Neuroscience (this document).

The Neurosciences Graduate Program Director (GPD) is
Dr. Heather Broihier
E714 (SOM)
368-4326; htb@case.edu

The GPD oversees graduate training in the Neurosciences Program. The GPD is available to discuss progress and provide advice on course selection. The GPD also coordinates student activities and serves as a student advocate should difficulties arise.

All students must submit a **Planned Program of Study (PPOS)** by the end of their 2nd semester through the Student Information System (SIS) by using the "Course Planner" and "My Program" tabs (the basic curriculum will be given to new students at their initial meeting with the GPD when they first arrive to the department. Credit hours should never exceed 9 hours in any semester since aid is not available for anything above 9 credit hours). If a student fails to submit a PPOS during the required time frame, a registration hold will be placed on the student's account. A revised program of study must also be submitted via the SIS when any change in the original plan occurs. Questions about the PPOS can be directed to Katie in the Neurosciences main office at kar18@case.edu, 368-6252. ***For a sample Planned Program of Study, please refer to the end of this handbook.***

Registration for classes is also done on-line in SIS.

Most students arrive July 1 and immediately begin a lab rotation. Because the summer session is not encumbered by coursework, often this rotation is an excellent laboratory experience. In the fall, students generally enroll as shown in the courses outlined below and pursue the remainder of their lab rotations.

Students are required by the University to take 36 semester hours of graduate courses before advancing to candidacy (**at least 24 hours must be from graded coursework**). For students entering with an approved master's degree, 18 semester hours are

required (**at least 12 hours must be from graded coursework**); this includes required courses, advanced electives at the 400 level or higher, and 601 research.

Neurosciences Ph.D. Program Requirements:
IBMS 453 Cell Biology I - (*formerly CBIO 453*)
IBMS 455 Molecular Biology I - (*formerly CBIO 455*)
IBMS 456 - Since You Were Born: Nobel Prize Biomedical Research in the Past 21 Years (*formerly CBIO 456*)
IBMS 450 Biostatistics, Rigor & Reproducibility in Data Analysis
IBMS 500 On Being a Professional Scientist: The Responsible Conduct of Research
IBMS 501 Responsible Conduct of Research for Advanced Trainees
(replaced NEUR 540 - Advanced Topics in Neuroscience Ethics - beginning in spring 2020)
NEUR 402 Principles of Neural Sciences
NEUR 419 Critical Thinking in Neuroscience
Elective graduate courses
A minimum of 18 hours of NEUR 701 thesis research

NEUR 415 Neurosciences Seminars *(students may register for this course up to two times for a total of (2) credit hours but are not required to register at all unless they need the credit to help them reach the credit hour requirement for graduation).*
~ Students must *attend* all seminars regardless of registration

Neurosciences Journal Club - Students are required to participate in and attend all weekly Journal Club presentations. There is no registration for Journal Club.

Suggested Course of Ph.D. Study

Year 1 Fall
IBMS 453 Cell Biology I (3 credits) – *Required, graded*
IBMS 455 Molecular Biology I (3 credits) – *Required, graded*
IBMS 456 Since You Were Born: Nobel Prize Biomedical Research in the Past 21 Years (1 credit) – *Required, graded*
IBMS 450 Biostatistics, Rigor & Reproducibility in Data Analysis (1 credit) – *Required, graded*
NEUR 601 Research in Neuroscience (1 credit)

Year 1 Spring
NEUR 402 Principles of Neural Sciences (3 credits) – *Required, graded*
Elective graduate course (3 credits) - *graded*
NEUR 415 Neuroscience Seminars (1 credit) – *graded*
NEUR 601 Research in Neuroscience (1 credit)
IBMS 500 On being a professional scientist: The Responsible Conduct of Research (1 credit) – *Required, Pass/No Pass*

Complete preliminary exam by July 31
Begin thesis research

Year 2 Fall
Elective courses (6 credits) - *graded*
NEUR 601 Research in Neuroscience (3 credits)

Year 2 Spring
NEUR 419 Critical Thinking in Neuroscience (3 credits) – *Required, graded*
Elective Courses (3 credits) - *graded*
NEUR 601 Research in Neuroscience (3 credits)

Complete Qualifier Exam by June 30
Form thesis committee
Research
Prepare individual fellowship application

Year 3 Fall
NEUR 701 Research in Neuroscience (number of credits to be advised)
Thesis Committee Meetings every 6 months

Year 3 Spring
NEUR 701 Research in Neuroscience (number of credits to be advised)
Thesis Committee Meetings every 6 months

Year 4
NEUR 701 Research in Neuroscience (number of credits to be advised)
Thesis committee meetings every 6 months

Year 5+
IBMS 501 Responsible Conduct of Research for Advanced Trainees *(required, P/NP, spring only) – Students will be notified by the BSTP/MSTP office when they are required to take this.*
NEUR 701 Research in Neuroscience (number of credits to be advised each fall and spring semester – must reach 18 credits of 701 to graduate)

Summer Sessions: Beginning in July 2022 and moving forward, no registration will be required for summer sessions unless you are going to defend in the summer; in this case, please see Katie

Fall Registration: Students must register for each fall semester by June 30th to keep their health insurance active over the summer months.

Medical Science Training Program (MSTP)
MSTP students in the neuroscience program are expected to complete the requirements for MSTP students as outlined in the MSTP guidelines. The general guidelines and performance expectations for MSTP students in the neuroscience program are identical to those for graduate students. Students are encouraged to take Neuroscience graduate courses during the first two years of medical school. In particular, in light of medical school curriculum changes, it is advised that MSTP students complete NEUR 402 during year 1 of medical school. In general, students are encouraged to take a graduate school elective

course in year 2 of medical school, while also preparing for the USMLE step 1. In keeping with MSTP, each student must have a member of the MSTP steering committee and one MD or MD/PhD. on the thesis committee. The MSTP steering committee member for Neurosciences is Dr. Jerry Silver (jxs10).

Laboratory Rotations and Selection

One of the most important decisions a student makes is the choice of a faculty advisor. To obtain experience in different laboratories, students must complete a minimum of three rotations, each lasting at least 6 weeks, during the Fall semester. Students are encouraged to start rotations July 1 to allow sufficient time to complete three rotations by the end of the Fall semester. Additional rotations are permitted during the early spring term if the student has not matched with an advisor and laboratory. These rotations give students a diverse introduction to approaches for studying neural function and serve as the basis for choosing a laboratory for the Ph.D. thesis. A student should realize that 20-25 hours per week of laboratory work are expected during the semester. A 3-page rotation report describing the project and a rotation evaluation form must be prepared at the conclusion of each rotation. After the form is completed, the student and faculty advisor meet to discuss comments. Copies of the rotation report and signed evaluation form are submitted to the graduate student advisor, the Neurosciences Office (give to Katie), and the BSTP Office (for BSTP students). This is the student's responsibility. All three rotation reports must be completed and evaluation reports signed before the preliminary examination can be scheduled.

By the end of the second semester, but as soon as the first semester, students commit to a specific laboratory and faculty advisor for doctoral studies. The date of this commitment is generally around December 15. Any faculty advisor who agrees to take a rotation student must do so only with confirmed financial support should the student decide to work in that laboratory. A faculty advisor who holds secondary faculty standing in the department of Neurosciences must receive approval by the Graduate Education Committee (GEC) and, additionally, the Chair prior to accepting a student into their lab.

Course Descriptions

Potential elective courses may be listed in Neurosciences, Cell Biology, Genetics, Pharmacology or other departments. This is a partial list of available courses:

IBMS 453: Cell Biology I (*formerly CBIO 453*) Credit Hours: 3.0
Offered every fall semester (required).
DUBYAK, G.
Description: Part of the first semester curriculum for first year graduate students along with CBIO 455. This course is designed to give students an intensive introduction to prokaryotic and eukaryotic cell structure and function. Topics include membrane structure and function, mechanisms of protein localization in cells, secretion and endocytosis, the cytoskeleton, cell adhesion, cell signaling and the regulation of cell growth. Important methods in cell biology are also presented. This course is suitable for graduate students entering most areas of basic biomedical research. Undergraduate courses in biochemistry, cell and molecular biology are excellent preparation for this course. Recommended preparation: Undergraduate biochemistry or molecular biology.

IBMS 455: Molecular Biology I (*formerly CBIO 455*) Credit Hours: 3.0
Offered every fall semester (required).
DUBYAK, G.
Description: Part of the first semester curriculum for first year graduate students along with CBIO 453. This course is designed to give students an intensive introduction to prokaryotic and eukaryotic molecular biology. Topics include protein structure and function, DNA and chromosome structure, DNA replication, RNA transcription and its regulation, RNA processing, and protein synthesis. Important methods in molecular biology are also presented. This course is suitable for graduate students entering most areas of basic biomedical research. Undergraduate courses in biochemistry, cell and molecular biology are excellent preparation for this course. Recommended preparation: Undergraduate biochemistry or molecular biology.

IBMS 456: Since You Were Born: Nobel Prize Biomedical Research in the Last 21 Years
(*formerly CBIO 456*) Credit Hours: 1.0
Offered every fall semester (required).
DUBYAK, G.
Description: This course is one of four sections that will cover major advances in biomedical research by review of Nobel Prize-winning topics from the past 21 years. Each section will cover 8 Nobel prize topics (1 topic/2-hour session/week for 8 weeks). Students will read critical research papers of the Nobel prize scientist(s) in preparation for guided in-class discussion led by the faculty mentor. The CBIO456A section will cover Nobel Prizes related to the areas of Genetics & Genome Science, Systems Biology & Bioinformatics, and RNA Biology. These include: 1) 2012 Prize, J. Gurdon and S. Yamanaka: Mechanisms of pluripotent stem cell development and reprogramming; 2) 2010 Prize, R. Edwards: Development of in ,vitro fertilization; 3) 2009 Prize, E. Blackburn, C. Greider, and J. Szostack: Mechanisms of chromosome protection by telomeres and telomerase; 4) 2009 Prize, Y. Ramakrishnan, T. Steitz, and A. Yonath: Structure/function analysis of ribosomes; 5) 2007 Prize, M. Capecchi, M. Evans, and O. Smithies: Discovery/development of transgenic and gene-deletion methods in mice; 6) 2006 Prize, A. Fire and C. Mello: Discovery/development of RNA interference-gene silencing methods; 7) 2006 Prize, R. Kornberg: Mechanisms of eukaryotic transcription; 8) 1995 Prize, E. Lewis, C. Nusslein-Volhard, and W. Wieschaus: Mechanisms of genetic control in early embryonic development.

IBMS 450: Fundamental Biostatistics to Enhance Research Rigor & Reproducibility Credit Hours: 1.0
Offered every fall semester (required).
SCHUMACHER, F.
Description: This is a required graduate level course for all first year PhD students in the School of Medicine biomedical PhD programs excluding Biomedical Engineering, Population and Quantitative Health Sciences, Molecular Medicine and Clinical Translation Science. This course focuses on providing students with a basic working knowledge and understanding of best practices in biostatistics that can be applied to common biomedical research activities in numerous fields. Weekly sessions involve a combination of basic programming activities, lectures, exercises, hands-on data manipulation and presentation. Topics include experimental design and power analysis, hypothesis testing, descriptive statistics, linear regression, and others with an emphasis on when and in which experimental design a particular test is properly used. The overall goal of the course is to empower students to use these biostatistics to enhance the rigor of their experimental design and reproducibility of their primary data. The major focus is not on theory, but on a practical acquisition of a working knowledge of basic data processing analysis, interpretation, and presentation skills.

IBMS 500: On Being a Professional Scientist: The Responsible Conduct of Research
Credit Hours: 1.0
Offered every spring semester (required).
WILSON-HOLDEN, T.
Description: The goal of this course is to provide graduate students with an opportunity to think through their professional ethical commitments before they are tested, on the basis of the scientific community's accumulated experience with the issues. Students will be brought up to date on the current state of professional policy and federal regulation in this area, and, through case studies, will discuss practical strategies for preventing and resolving ethical problems in their own work. The course is designed to meet the requirements for "instruction about responsible conduct in research" for BSTP and MSTP students supported through NIH/ADAMHA institutional training grant programs at Case. Attendance is required.

IBMS 501: Responsible Conduct of Research for Advanced Trainees Credit Hours: 0.0
Offered every spring semester (Students will be notified by Paul MacDonald when they are required to take this, usually around their 5th year of study). (required).
MACDONALD, P.
The life of a professional scientist is complicated, and it is not always easy to know how to "do the right thing" with regard to their data, colleagues, and subjects. Responsible Conduct of Research (RCR) is an essential component of research knowledge. Active thought about the issues of RCR should occur throughout a scientist's career. Instruction in RCR should be appropriate to the career stage of the individuals receiving training. All doctoral students in the School of Medicine receive initial RCR training in their second semester and NIH requires another intense exposure if doctoral students are four years beyond their initial training. The goal of this course is to provide fifth year biomedical doctoral students with additional RCR training by exposing them to a variety of research ethics topics through lectures and small group discussions led by professional scientists and ethicists. Students will be brought up to date on the current state of professional policy and federal regulation regarding research (where these exist), and will discuss practical strategies for preventing and resolving ethical problems in their own work. This course is designed for predoctoral graduate students that are in their fifth year of graduate studies and MSTP students that are in their fourth year of their PhD phase of study. These sessions are also appropriate for postdoctoral trainees.

NEUR 401*: Biological Mechanisms of Brain Disorders Credit Hours: 3.0
Offered every fall semester.
FRIEL, D.
Description: This course is designed to introduce students to a broad range of neurological and neuropsychiatric diseases and disorders in order to understand how genetic and environmental perturbations can disrupt normal brain function. The primary focus will be on understanding the biological bases of nervous system dysfunction. For each disease discussed, the subject matter will be organized to explain how normal brain function is impacted, the biological mechanisms underlying dysfunction (including still-unanswered questions) and current efforts to develop effective treatments (translational research). With this approach, students will gain an understanding of disease presentation, how animal models and human studies are being used to elucidate pathophysiological mechanisms, and opportunities and challenges in the development of new therapies. The class format will be a mix of lecture-based sessions and discussions of scientific journal articles.
Prereq: Undergraduate: BIOL 216 or PSCL 352; Graduate: Permission of instructor.
***** Cross-listed: Undergraduates should register for NEUR 301/Graduates should register for NEUR 401

NEUR 402: Principles of Neural Science Credit Hours: 3.0
Offered every spring semester (required).
STROWBRIDGE, B.
Description: Lecture/discussion course covering concepts in cell and molecular neuroscience, principles of systems neuroscience as demonstrated in the somatosensory system, and fundamentals of the development of the nervous system. This course will prepare students for upper level Neuroscience courses and is also suitable for students in other programs who desire an understanding of neurosciences. Prereq: CBIO 453. Cross-listed as BIOL 402.

NEUR 405: Cell and Molecular Neurobiology Credit Hours: 3.0
Offered fall semester as needed.
DENERIS, E. and FRIEL, D.
Description: Cell biology of nerve cells, including aspects of synaptic structure physiology and chemistry. The application of molecular biological tools to questions of synaptic function will be addressed. Prereq: BIOL 473.

NEUR 415: Neuroscience Seminars Credit Hours: 1.0
Offered every fall and spring semesters. *(Students can register for this up to two times for a total of two credit hours).*
BROIHIER, H.
Description: Current topics of interest in neurosciences. Students attend weekly seminars. From this series, students prepare critiques. No credit is given for less than 75% attendance.

NEUR 419: Critical Thinking in Neuroscience Credit Hours 3.0
Offered every spring semester to 2nd year students (required).
FRIEL, D.
Description: The goal of this course is to develop the student's critical reasoning skills through reading and discussing primary research papers. Each year, the course will focus on 3-4 different topics selected by participating Neurosciences faculty members. Students will receive a letter grade based on their contributions to discussions, and at the discretion of the faculty, performance on exams and /or term paper. Prereq: NEUR 402.

NEUR 432: Current Topics in Vision Research Credit Hours 3.0
Offered alternating years, spring semester (even years).
PARK, PAUL
Description: Vision research is an exciting and multidisciplinary area that draws on the disciplines of biochemistry, genetics, molecular biology, structural biology, neuroscience, and pathology. This graduate level course will provide the student with broad exposure to the most recent and relevant research currently being conducted in the field. Topics will cover a variety of diseases and fundamental biological processes occurring in the eye. Regions of the eye that will be discussed include the cornea, lens, and retina. Vision disorders discussed include age-related macular degeneration, retinal ciliopathies, and diabetic retinopathy. Instructors in the course are experts in their field and are members of the multidisciplinary visual sciences research community here at Case Western Reserve University. Students will be exposed to the experimental approaches and instrumentation currently being used in the laboratory and in clinical settings. Topics will be covered by traditional lectures, demonstrations in the laboratory and the clinic, and journal club presentations. Students will be graded on their performance in journal club presentations (40%), research proposal (40%), and class participation (20%). Offered as NEUR 432, PATH 432, PHRM 432 and BIOC 432.

NEUR 466: Cell Signaling Credit Hours 3.0
Offered every spring semester.
DUBYAK, G.
Description: This is an advanced lecture/journal/discussion format course that covers cell signaling mechanisms. Included are discussions of neurotransmitter-gated ion channels, growth factor receptor kinases, cytokine receptors, G protein-coupled receptors, steroid receptors, heterotrimeric G proteins, ras family GTPases, second messenger cascades, protein kinase cascades, second messenger regulation of transcription factors, microtubule-based motility, actin/myosin-based motility, signals for regulation of cell cycle, signals for regulation of apoptosis.
Cross-listed as CLBY 466 and PHOL 466 and PHRM 466.

NEUR 473: Introduction to Neurobiology Credit Hours: 3.0
Offered every fall semester.
CHIEL, H.
Description: How nervous systems control behavior. Biophysical, biochemical, and molecular biological properties of nerve cells, their organization into circuitry, and their function within networks. Emphasis on quantitative methods for modeling neurons and networks, and on critical analysis of the contemporary technical literature in the neurosciences. Term paper required. Two lectures per week. Prereq: Consent of department. Cross-listed as BIOL 473

NEUR 474: Neurobiology of Behavior Credit Hours: 3.0
Offering is variable.
RITZMANN, R.
In this course, students will examine how neurobiologists interested in animal behavior study the linkage between neural circuitry and complex behavior. Various vertebrate and invertebrate systems will be considered. Several exercises will be used in this endeavor. Although some lectures will provide background and context on specific neural systems, the emphasis of the course will be on classroom discussion of specific journal articles. In addition, students will each complete a project in which they will observe some animal behavior and generate both behavioral and neurobiological hypotheses related to it. In lieu of examinations, students will complete three written assignments, including a theoretical grant proposal, a one-page Specific Aims paper related to the project, and a final project paper. These assignments are designed to give each student experience in writing biologically-relevant documents. Classroom discussions will help students understand the content and format of each type document. They will also present their projects orally to the entire class.
(See BIOL 374). Cross-listed as BIOL 474.

NEUR 475: Protein Biophysics Credit Hours: 3.0
Offered every fall and spring semester.
BUCK, M.
Description: This course focuses on in-depth understanding of the molecular biophysics of proteins. Structural, thermodynamic and kinetic aspects of protein function and structure-function relationships will be considered at the advanced conceptual level. The application of these theoretical frameworks will be illustrated with examples from the literature and integration of biophysical knowledge with description at the cellular and systems level. The format consists of lectures, problem sets, and student presentations. A special emphasis will be placed on discussion of original publications. Offered as BIOC 475, CHEM 475, PHOL 475, PHRM 475, and NEUR 475.

NEUR 478: Computational Neuroscience Credit Hours: 3.0
Offered alternating years, spring semester (odd years)
THOMAS, Peter (MATHEMATICS)
Description: Computer simulation of neurons and neural circuits, and the computational properties of nervous systems. Students are taught a range of models for neurons and neural circuits, and are asked to implement and explore the computational and dynamic properties of these models. The course introduces students to dynamical systems theory for the analysis of neurons and neural circuits, as well as to cable theory, passive and active compartmental modeling, numerical integration methods, models of plasticity and learning, models of brain systems, and their relationship to artificial neural networks. Term project required. Two lectures per week. Cross-listed with EECS 478 & BIOL 478.

NEUR 601: Research in Neuroscience Credit Hours: 1.0 - 18.0

NEUR 651: Thesis M.S. Credit Hours: 1.0 - 6.0
(Credit as arranged). Prereq: M.S. candidates only.

NEUR 701: Dissertation Ph.D. Credit Hours: 1.0 - 18.0

Responsible Conduct in Research. All students are required to complete 2 courses to satisfy the responsible conduct in research requirement. **IBMS 500: ON BEING A PROFESSIONAL SCIENTIST** (1) credit hour, must be taken in spring of the first year of study. This course outlines fundamental information and some case studies. It can be counted in the 36 total credit hours required to advance to candidacy but it cannot be used as graded course work. A second responsible conduct course, **IBMS 501: RESPONSIBLE CONDUCT OF RESEARCH FOR ADVANCED TRAINEES** (0) credit hours, will be completed in the 5th year of graduate study (spring semesters) and engages more detailed discussion. Students, postdocs and faculty are encouraged to participate in monthly workshops presented by the Office of Research Compliance (http://ora.ra.cwru.edu/research/orc/rcr/index.cfm; workshop calendar at http://ora.ra.cwru.edu/research/orc/education/onlinecalendar.cfm).

Examinations

Progress toward the PhD is marked by grades in coursework, laboratory research and successful completion of exams. University regulations regarding quality point average and academic probation form the minimum expectations of our students. Any student with a grade point average below 3.0 at the end of the 2nd or 4th semesters of graduate study may be separated from the University by a majority vote of the primary faculty in the Department of Neurosciences.

Preliminary Exam--end of first year, following identification of faculty advisor. The goal of this exam is to identify students who exhibit significant gaps in basic knowledge and critical thinking ability. The student will be assigned a paper published within the

past year in the Journal of Neuroscience. This paper will be randomly selected from a suitable pool of papers chosen by the Graduate Education Committee. **The advisor and two additional primary Neuroscience training faculty** who are selected by rotation from a list of all training faculty (see Heather Broihier to determine the composition of your committee) form an examination committee. The chair of the committee must be a primary faculty member in the Neurosciences Department. One week later the student will make a 45 min. presentation of the paper including relevant background, methods used, and a critique of its experimental design and findings. The student will be broadly questioned in an exam that typically takes 1.5 hours. Students should practice their presentations to ensure that the time limit is met. The student must be prepared to discuss all facets of the paper but should emphasize its important strengths and weaknesses. Successful completion of the exam is required for progression to the second year of graduate school. A personalized course of study may be recommended if significant deficiencies are identified. The exam committee chair will submit a written report within one week to the GPD. **The exam must be completed by July 31 of the first year of study**. Immediately after completion of the oral presentation, the exam committee will meet with the trainee to communicate whether the trainee passed or failed the exam. In the event of failure, the trainee will be given detailed feedback regarding the committee's grounds for failing the trainee. The trainee will then be permitted to request a 2nd and final attempt to pass the exam at a later date with assignment of another Journal of Neuroscience research paper. A 2nd failed attempt to pass the preliminary exam will be grounds for separation from the program and immediate termination of PhD training.

Qualifying Exam--end of second year, following completion of required coursework. This exam tests the ability of a student to propose creative and feasible experiments to test hypotheses and advance knowledge. A **four-member committee** will be determined by the faculty advisor and student and must include at least three primary Neurosciences training faculty. If the advisor is not a primary Neuroscience faculty member, the other 3 committee members must be primary faculty members. The chair of the exam committee must be a primary faculty member in the Neurosciences Department. A grant topic will be selected by the faculty committee and given to the student. At the advisor's discretion, this topic may be (1) directly related to the student's research project, (2) more loosely based on the advisor's research interests, or (3) entirely off topic.

One week after receiving the topic, the student will submit specific aims for the proposal that must be approved by the committee. Three weeks later (4 weeks total), the student will submit to the committee a ten-page single spaced research proposal (including a specific aims page, background & significance, and experimental design with necessary methods). Essential displays (Tables, Figures) are part of the ten-page limit. Cited references are outside the ten-page limit. The proposal should describe 2 or more experimental aims that are feasible within a 3-year time interval. Questions about the topic should be directed to members of the student's examination committee and not to other faculty. One week after submitting the proposal the student will give an oral presentation to the committee and defend the proposal. Immediately after completion of the oral presentation, the exam committee will meet with the trainee to communicate whether the trainee passed, conditionally passed, or failed the exam. In the event of receiving a conditional pass, the trainee must address serious deficiencies identified by the exam committee in either written proposal and/or oral presentation. In the event of failure, the trainee will be given detailed feedback regarding the committee's grounds for failing the trainee. The trainee will then be permitted to request a 2nd and final attempt to

pass the exam at a later date. A 2nd failed attempt to pass the qualifying exam will be grounds for separation from the program and immediate termination of PhD training.
The chair will submit a report to the GPD within one week. **This exam should be completed by June 30 of the second year of study**. Satisfactory performance on this exam will admit the student to Candidacy for the Ph.D. in accordance with University guidelines. Copies of successful past proposals are available for students to view (see Katie Wervey).

Change of State Notification. The graduate school requires written notification of every advancement in a graduate student's progress to mark each of the following events 1) selection of research advisor 2) selection of thesis committee members 3) successful completion of qualifying exam 4) successful completion of Ph.D. program. Students should email Katie Wervey (kar18) to let her know these advancements have been achieved.

Research Integrity. Students should carefully attribute material generated by others. "As a general working definition, the Office of Research Integrity considers plagiarism to include both the theft or misappropriation of intellectual property and the substantial unattributed textual copying of another's work. It does not include authorship or credit disputes. Substantial unattributed textual copying of another's work means the unattributed verbatim or nearly verbatim copying of sentences and paragraphs which materially mislead the ordinary reader regarding the contributions of the author. ORI generally does not pursue the limited use of identical or nearly identical phrases which describe a commonly used methodology or previous research because ORI does not consider such use as substantially misleading to the reader or of great significance." For more information on this issue, see http://ori.dhhs.gov/policies/plagiarism.shtml

GUIDELINES FOR THESIS RESEARCH

Goals for the Training Faculty:

Training faculty of Ph.D. students must be active participants in the Neurosciences Program and contribute to courses, collaborative research projects and/or journal clubs. The program periodically reviews faculty for training status, and faculty who have been inactive will be declined.

The thesis advisor must provide the student with intensive training in the scientific method, including the ability formulate clear research questions, develop feasible research approaches to answering such questions, evaluate data from the student's own research and that of others, and discuss the broad context and significance of the student's work.

The thesis advisor, in conjunction with the Thesis Committee, is responsible for developing and implementing a training plan with the student, including the elaboration of an independent research project.

The thesis advisor is responsible for providing physical, financial, and intellectual resources necessary for accomplishing the research plan.

The thesis advisor should work regularly with the student to develop good communication skills, in both speaking and writing.

The thesis advisor should encourage the student to think broadly about the research project and not necessarily be limited to approaches/techniques currently used in the advisor's laboratory.

The Thesis Committee

Graduate training has as its goal the extension of knowledge and the development of scholarship. This requires input from faculty advisors who work together with the student and faculty advisor to guide the scope of the research, and help the student develop into an authority in his/her field. Thesis committee members should have expertise that corresponds with the proposed work and an acknowledged interest in contributing constructively to the student's progress.

Upon successful completion of the qualifying exam, each student will notify the Graduate Student Coordinator (Katie Wervey) so the Advancement to Candidacy form can be filled out and sent to Graduate Studies. Students have 6 months from their qualifier to form their thesis committees and must notify Katie with the names of the committee members, who will be the chair of the committee, and when the first meeting will take place.

The thesis committee shall have a minimum of four tenured or tenure-track CWRU faculty members, three of which must be primary Neurosciences faculty (including the thesis advisor) and the University requires that one member of the committee has a CWRU primary appointment outside this department. The chair of the committee must be a Neurosciences primary faculty member. Persons who are not members of the University faculty may serve as *additional* members of the defense committee, subject to approval by the School of Graduate Studies. A petition with the rationale for the request must be presented to the School of Graduate Studies along with the proposed member's curriculum vitae. The Dean must approve all of these additional members.

A primary appointee in the Department of Neurosciences chairs the meetings. The committee is to serve as the student's advocate in advancing toward the doctorate. The student should feel free to consult individual members at any time. The presence of one half plus one of the members of the committee constitutes a quorum. The membership of the thesis committee can change during the course of work, and is recommended if the direction of work shifts substantially. When the committee agrees that the body of work accomplished is adequate to earn a doctoral degree, the purpose of the committee takes on the additional role of ensuring the completion of a scholarly thesis.

At the **first committee meeting**, the trainer must bring the student file and rotation reports, and preliminary exam and qualifying exam reports should be reviewed at this time. The first meeting need accomplish no more than a discussion of the general topics for thesis research. A frank discussion of the strengths and weaknesses of the work should be encouraged. The meeting should end with the development of a consensus plan for the next 6 months. Subsequent meetings should put new work in the context of the entire project, and outline advances and proposed areas for work. The committee chair must send a short synopsis of the meeting to the GPD and Neuroscience Departmental Assistant within one week.

The Thesis Committee must meet at least once a semester to monitor student progress. It is the responsibility of both the Chair of the Committee and the student that these meetings take place. Students will not be allowed to register for a semester if there has not been a Committee meeting during the previous half-year period.

At least two weekdays prior to each meeting, a brief written summary of the student's progress since the last meeting should be given to each committee member. It is the responsibility of committee members to read the report prior to the committee meeting.

After every meeting, a date for the next meeting will be set for 6 months later (unless directed by the committee to meet sooner), so that the student and committee members can enter it into their calendars. **It is a requirement that students and their committees meet every 6 months, even if the student does not feel he or she has enough data to report, so that the committee can be kept up-to-date on his or her progress and can advise the student.**

The Thesis Committee evaluates the strengths and deficiencies in the training plan or in its implementation and discusses these with the mentor and student. The Committee should serve as a sounding board if the student encounters problems in the graduate program and should create a relationship with the student where it is clear that such interchanges are encouraged.

The Committee is responsible for seeing that the standards and the requirements of the program are fulfilled. It is ultimately the responsibility of the Chair of the Committee to bring any unresolved problems to the attention of the Director of Graduate Studies and/or the Departmental Graduate Education Committee.

Progress Reports must be completed within one week of the committee meeting and sent to the members of the committee and to the Departmental Assistant for placement in the student's confidential folder. The report must contain a clear assessment of whether or not "**satisfactory progress**" is being made towards a Ph.D. degree. This assessment is one of the key responsibilities of the Advisory Committee. If the student receives two unsatisfactory grades in NEUR 701, the student is separated from the University.

If the student, mentor and committee cannot come to an agreement about the training plan, they should bring their differences to the Departmental Graduate Education Committee (* see under "Student Advocates" – next section), the GPD, or the Chair of the Department. The Thesis Committee is responsible for approving the shift in the student's priorities from doing experiments to writing the thesis. Before doing this, the student must present to the Committee a brief outline of the proposed written thesis.

The Dissertation

All candidates for the PhD degree must submit a written dissertation as evidence of their ability to conduct independent research at an advanced level. The dissertation must represent a significant and original contribution to existing knowledge in the student's field. At least six months before the student anticipates PhD completion, a thesis committee meeting should be held to discuss whether the student's progress toward the degree is sufficient. By the time of the thesis examination, the student should have accepted for publication (or accepted pending minor revisions) at least one *peer reviewed* manuscript, excluding reviews, chapters, or commentaries, on which he/she is the first author. Co-first author papers can be counted towards this criterion, at the discretion of the thesis committee. The first draft of all manuscripts should be entirely written by the student. The committee should agree at that time to the format of the thesis. It is in a student's interest to submit any manuscripts before leaving the University, because once a postdoctoral position is begun, other concerns arise. Because many students have published manuscripts on their studies, the thesis often reflects that work as chapters,

placed in context with a general Introduction, and a Discussion that considers the relevance of the studies. Examples of Neuroscience graduate theses are in the Neuroscience library. Detailed regulations concerning format, quality, time of submission and oral defense are established by the Dean of Graduate Studies and Research, and instructions are available from the Office of Graduate Studies.

Student Advocates. In the event that difficulties arise during graduate training, a student is advised to seek advice from one or more sources including the student's faculty advisor, the GPD, the Graduate Education Committee, the departmental chairperson or if relevant, the MSTP director. The Graduate Education Committee within the Dept. of Neurosciences will meet on an ad hoc basis to discuss policy issues in Graduate Education. A graduate student, thesis advisor, Committee member, or GPD can bring to the Committee at any time cases where serious breakdowns in communication have occurred with respect to the students' graduate studies and ask the Committee to intervene. Members of the Graduate Education Committee include Drs. Heather Broihier, Richard Zigmond and Evan Deneris (Committee Chair). Students are also encouraged to seek advice from the Director of Graduate Education. If necessary, students may express a grievance against actions of students or faculty and staff through procedures handled by Graduate Studies (for academic problems) or the University Office of Student Affairs (for non-academic problems). Members of the University community who believe they have been sexually harassed are entitled to an investigation; officials in the Provost's Office, Office of Student Affairs and/or the Office of Affirmative Action/Equal Employment Opportunity will provide options for resolution.

Master of Neuroscience Degree. The Neuroscience program is a Doctoral degree granting program and does not offer a Master of Science curriculum. No student will be admitted to the Program for the sole purpose of earning a M.S. degree, and under no circumstances will a Master's degree be awarded as part of a Doctoral curriculum. On rare occasions, however, an individual may leave the Doctoral program after completing a significant body of course work and independent research. Under these conditions, a Master of Neuroscience degree **Non-Thesis Option (Type B)** may be awarded under the recommendation of the student's thesis or qualifying committee. To complete the requirements for a Master of Neuroscience, a student must maintain continuity of registration and a minimum cumulative grade point average of 3.0 (see School of Graduate Studies then "Academic Policies" then "Maintenance of Grade Point Average"). The student must successfully pass the preliminary exam as well as a special Master's qualifying exam, and have completed a minimum of 30 semester hours of course work. Of these, at least 18 hours must be from graded course work and must be at the 400 level or higher. Any requirements not specifically addressed herein must conform to the regulations for the Master's degree specified in the University General Bulletin, School of Graduate Studies Academic Requirements. This program is aimed at students who have taken most or all of the courses required for the Ph.D. and who have pursued a research program. To earn this Master's degree one of two examinations must be passed: Passage of the Neuroscience qualifier exam or successful oral defense of a research report. The Neuroscience qualifier examination consists of an "NIH style" research proposal that has both written and oral components. The research report is based on the student's original research and will be tested in an oral examination by the student's advisory committee. Upon successfully passing one of the two examinations and fulfilling the above requirements, these students will earn a Master of Science in Neurosciences.

International students. The University Attorney's office, Office of Foreign Faculty and Scholars (x4289, FAX x1881) is a resource for international students.

Additional information regarding graduate training at CWRU can be found through the Office of Graduate Studies (gradstudies.case.edu).

Undergraduate Neurosciences Courses

NEUR 166: Explorations in Neuroscience (Undergraduate Course)
Credit Hours: 1.0 (Pass/No Pass)
Offered every fall semester
Instructor: FRIEL, D.
Description: This survey course provides students with an opportunity to learn about some of the most exciting and timely concepts in neuroscience, including topics in basic and translational research, as well as perspectives on neuroscience as a profession, through a series of 14 lectures given by members of the Neurosciences Department in the Case Western Reserve University School of Medicine. Topics are presented in a way that can be understood by students who have taken a high school biology class. Every effort is made to explain any new concepts that are included in the lectures. Each lecturer will provide general background reading material for the topics they discuss.

NEUR 201: Fundamentals of Neuroscience I Credit hours: 3.0 (Undergraduate Course)
Offered every fall semester.
NEMES-BARAN, A.
Description: The purpose of this course is to provide students with an overview of neuroscience, with an emphasis on the functional properties of neural systems. This is the first of two courses that are required for the neuroscience major. The second course, Fundamentals of Neuroscience II, examines the cellular and molecular properties that underlie the functional properties of neural systems. Topics that will be discussed, and the level at which they are discussed, assumes that students have a basic familiarity with cell structure and function and specialized properties of cells found in different physiological systems, from their previous coursework in BIOL 214, 215, 216. The course will also provide a foundation for elective upper-level courses in the undergraduate neuroscience curriculum.

NEUR 202: Fundamentals of Neuroscience II Credit hours 3.0 (Undergraduate Course)
Offered Every spring semester (first offered spring 2021)
NEMES-BARAN, A.
Description: This course is designed for undergraduates in their sophomore year to provide them with an understanding of signaling mechanisms that are utilized by nerve cells, including mechanisms that are responsible for signaling within cells and mechanisms that underlie signaling between cells. These mechanisms will range from the fast, millisecond time-scale transitions of ion channels that contribute to action potentials and synaptic signaling, to slower events that underlie modulation of channel activity and neurotransmitter synthesis and degradation, to even slower events on the hour and day timescale involving changes in gene expression and protein synthesis that underlie phenotypic development and neural plasticity. Prereq: NEUR 201.

NEUR 301*: Biological Mechanisms of Brain Disorders Credit Hours: 3.0
Offered every fall semester.
FRIEL, D.
Description: This course is designed to introduce students to a broad range of neurological and neuropsychiatric diseases and disorders in order to understand how genetic and environmental perturbations can disrupt normal brain function. The primary focus will be on understanding the biological bases of nervous system dysfunction. For each disease discussed, the subject matter will be organized to explain how normal brain function is impacted, the biological mechanisms underlying dysfunction (including still-unanswered questions) and current efforts to develop effective treatments (translational research). With this approach, students will gain an understanding of disease presentation, how animal models and human studies are being used to elucidate pathophysiological mechanisms, and opportunities and challenges in the development of new therapies. The class format will be a mix of lecture-based sessions and discussions of scientific journal articles.
Prereq: Undergraduate: BIOL 216 or PSCL 352; Graduate: Permission of instructor.
* Cross-listed: Undergraduates should register for NEUR 301/Graduates should register for NEUR 401.

NEUR 303 – Methods Neuroscience Research (Laboratory) Credit Hours: 3.0 (new spring 2022)
Offered every spring semester
NEMES-BARAN, A.
Description: This course will provide students the knowledge necessary to choose the appropriate methods needed to explore scientific questions, understand ethical research design, use safe laboratory practices and develop research skills that are highly valuable in the field of neuroscience. The topics covered in this course include basic laboratory skills, neuroanatomy, histology, neurophysiology and behavioral neuroscience. Successful completion of this course will equip students with the kinds of practical knowledge and hands-on experiences that can enhance competitiveness for internships, doctoral training programs or careers in research laboratories. Prereq: NEUR 201.

NEUR 304: The Neurobiology of Homeostasis Credit Hours: 3.0 (new fall 2022)
Offered every fall semester
NEMES-BARAN, A.
Description: This course will explore the relationship between the body and the brain through homeostasis from its development to its decline, while reviewing the known literature and discussing unanswered questions. Students will learn the basics of homeostasis in normal nervous system development and consider current research investigating perturbations leading to disorders and abnormal development. Systems that interact with the central nervous system, including the endocrine system, the immune system, and the enteric system, will be introduced and impairments in nervous system communication with these systems will be discussed in regards to neurological diseases, neuropsychiatric disorders, and injury and repair, while incorporating discussions of current diagnostic techniques, prevention and treatment. The conclusion of the course will focus on changes in the nervous system that lead to cognitive decline, memory impairments and motor deficits common in aging and neurodegenerative disorders. The overarching theme will focus on homeostatic mechanisms and how their impairment can have detrimental effects on the nervous system and its interactions with the peripheral systems throughout the lifespan. Prereq: NEUR 201

NEUR 388 - Undergraduate Research in Neuroscience Credit Hours 3.0
Offered every semester.
FRIEL, D., NEMES-BARAN, A.
Description: Guided laboratory research under the sponsorship of a SOM faculty member who conducts basic and/or translational neuroscience research. Students are required to obtain permission from the prospective research supervisor and the Neuroscience Undergraduate Curriculum Committee (NUCC) prior to enrolling in the course. Appropriate forms must be submitted to the Neurosciences Department office. At the end of the semester, a research report, written in the format of a scientific research publication, must be submitted and approved by the research mentor and the NUCC before credit is granted. 3 credits. Graded Pass/NoPass.

NEUR 388S - Undergraduate Research SAGES Capstone Credit Hours 3.0
Offered every semester.
FRIEL, D., NEMES-BARAN, A.
Description: Guided laboratory research supervised and guided by a SOM faculty member who conducts basic and/or translational neuroscience research. Students are required to obtain permission from the prospective research supervisor and the Neuroscience Undergraduate Curriculum Committee (NUCC) prior to enrolling in the course. Appropriate forms must be submitted to the Neurosciences Department office. At the end of the semester, a research report, written in the format of a scientific research publication, must be submitted and approved by the research mentor and the NUCC before credit is granted. A public presentation is required. 3 credits. Graded A-F.

NEUR 390 - Advanced Undergraduate Research in Neuroscience Credit Hours: 1.0 – 3.0
Offered every semester.
Contact: FRIEL, D., NEMES-BARAN, A.
Description: Guided research under the sponsorship of a SOM faculty member who conducts basic and/or translational neuroscience research. Students are required to obtain permission from the prospective research supervisor and the Neuroscience Undergraduate Curriculum Committee (NUCC) prior to enrolling in the course. Appropriate forms must be submitted to the Neurosciences Department office. Does not count toward the hours required for a major in neuroscience, but may be counted toward the total number of hours required for graduation. At the end of the semester, a written report must be submitted and approved by the research mentor and the NUCC before credit is granted.
Graded Pass/NoPass.

SAMPLE Planned Program of Study (PPOS) to be entered into SIS

Your PPOS is a ***plan*** for your courses and should **include all courses you have already taken and will take in your first two years.** If you do not know exactly what you'll be taking you will still need to fill in ***something*** for the Graduate Studies requirement of having a PPOS on file by the end of your 2nd semester. You can always change it later if you end up taking different courses than what you originally planned.

Deadlines: **May 20th** have PPOS submitted and approved by Heather Broihier (you will not be allowed to register for summer and fall until your PPOS has been submitted).
June 30th deadline to register for fall courses (you must be registered by this date to prevent a lapse in health insurance coverage over the summer.

To submit your PPOS:
Graduate Studies Link: https://case.edu/gradstudies/current-students/planned-program-study
1. For instructions on how to submit your PPOS click on "Quick reference guides for creating, updating, or approving a PPOS" on the Graduate Studies webpage.
2. To access SIS to submit your PPOS, click on "Submit Your PPOS through SIS" found in the blue box on the right.

Remember: **You must be registered for a total of (9) credit hours every fall and spring semester in your first two years.** Once students advance to candidacy, they are required to take NEUR 701 credits but these do not need to be recorded in your PPOS; do, however, list IBMS 501 in year 5 (see next page).

Credit hours needed to advance to candidacy and to graduate (must be reflected in PPOS):
If you came in with a:

1. Bachelor's degree: 36 total with a minimum of 24 hours from graded coursework.
2. Master's degree: 18 total with a minimum of 12 hours from graded coursework.

Once you have submitted your PPOS it will go to Heather Broihier for approval. If approved, it then goes to Graduate Studies for final approval. If Heather does not approve it, it will be routed back to you and she will explain why it was denied. At that point, go back in and make the changes and submit it again.

** If you have any questions, you can ask Katie or Heather.*

A note about NEUR 601 Research Credits:
601 credits are used as "fillers" for when you do not reach the (9) credit hour requirement per semester. For example: If you take two (3) credit hour courses in one semester, you still need (3) credits to reach (9). In this case you would register for (3) credits of NEUR 601 if you are not going to take another course. Likewise, if you have registered for (7) credit hours of coursework, add (2) credits of NEUR 601. If you take 3 courses (3 credits each), you will not register for any 601 credits.

** Contact Katie Wervey at 368-6252 (kar18@case.edu) or Heather Broihier 368-4326 (htb@case.edu) with questions.*

SAMPLE Planned Program of Study (PPOS) to be entered into SIS (cont'd)

Term/Year	Course #	Course Name	Grading Basis	Units
	Year 1			
Fall	IBMS 453 *required*	Cell Biology 1	Graded	3
	IBMS 455 *required*	Molecular Biology 1	Graded	3
	IBMS 456 *required*	Since You Were Born: Nobel Prize Biomedical Research in the Past 21 Years	Graded	1
	IBMS 450 *required*	Biostatistics, Rigor & Reproducibility in Data Analysis	Graded	1
	BSTP 400 or NEUR 601	Research in Neurosciences	Pass/NoPass	1
				Total: 9
Spring	NEUR 402 *required*	Principles of Neural Science	Graded	3
	NEUR 415	Neuroscience Seminars	Graded	1
	IBMS 500 *required*	Being a Professional Scientist (*Not graded*, it's Pass/No Pass but counts toward total 36 credits needed to graduate)	Pass/NoPass	1
		Elective Graduate Course	Graded	3
	NEUR 601	Research in Neuroscience	Pass/NoPass	1
				Total: 9
	Year 2			
Fall	Combination of Elective Graduate Courses and NEUR 601 Research in Neuroscience Credits to equal 9 credits			
		Elective Graduate Course	Graded	3
		Elective Graduate Course	Graded	3
	PHRM 526	Grant Writing Tutorial (recommended)	Graded	2
	NEUR 601	Research In Neuroscience	Pass/NoPass	1
				Total: 9
Spring	NEUR 419 *required*	Critical Thinking in Neuroscience	Graded	3
	NEUR 601	Research in Neuroscience	Pass/NoPass	6
				Total: 9
A TOTAL of 36 credit hours with at least 24 of these hours being from *GRADED* coursework are needed to Advance to Candidacy and before taking 701 credits *(for those who came in with a master's degree a TOTAL of 18 credit hours with at least 12 of these hours being from GRADED coursework are needed).*				
	Year 5			
Spring	IBMS 501 *required*	Responsible Conduct of Research for Advanced Trainees ***(0 credit hours but still required)***	Pass/NoPass	Total: 0

This sample shows 36 total credit hours with 26 hours from graded coursework.